

Gravity Station Escape

Gravity & the Earth-Sun-Moon System: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses, and seasons; describe the role of gravity in the motions within galaxies and the solar system; and analyze data to determine scale properties of objects in the solar system.

Learning target: I can use a model of the Earth-Sun-Moon system to explain phases, eclipses, tides, and seasons, and explain how gravity keeps objects in orbit.

Success looks like: Students use the vocabulary correctly, complete the escape room, and score 80% or higher on the evidence-based exit ticket.

Materials: Student devices, the printed lesson worksheet (one per student), projector for the mini-lesson presenter.

LESSON AT A GLANCE

60 minutes

Time	Part	Teacher does	Students do
0:00-0:08	Warm-up	Project the warm-up. Circulate, then call on 2-3 students. Save question 3 for the debrief.	Answer Part 2 of the lesson worksheet; share with a partner.
0:08-0:20	Mini-lesson	Teach with the 4-step presenter. Run each quick check with the whole class.	Complete worksheet Parts 4-11 as each slide appears; answer checks with fingers.
0:20-0:48	Escape Room	Launch Gravity Station Escape. Assign mission levels; circulate with the answer key.	Play solo or in pairs; record code pieces; complete any written evidence task.
0:48-0:52	Debrief	Ask 2 debrief questions and revisit warm-up question 3.	Finish worksheet Part 13 (prediction check + one thing learned).
0:52-1:00	Exit ticket	Hand out the exit ticket. Collect and sort with the mastery guide.	Answer with evidence independently.

Key vocabulary

Word	Student-friendly definition
Gravity	A force of attraction between all objects with mass. More mass and less distance means stronger gravity.
Orbit	The curved path of one object around another, caused by gravity and forward motion.
Solar eclipse	The Moon passes between the Sun and Earth, blocking sunlight.
Lunar eclipse	Earth passes between the Sun and the Moon; Earth's shadow falls on the Moon.
Tide	The daily rise and fall of sea level, caused mostly by the Moon's gravity.

Word	Student-friendly definition
Waxing / waning	The lit part of the Moon growing / shrinking.

1. WARM-UP

0:00–0:08 · 8 min

Warm-up expectations (post these): Answer in Part 2 of the lesson worksheet (or on this sheet). Number each answer to match the question. Answer in complete sentences. For math, show your work. Work silently for 5 minutes, then share with a partner for 2 minutes. Be ready to share one answer with the class.

#	Question	Look for
1	What force makes a dropped ball fall to the ground?	Gravity.
2	How long does it take the Moon to go through all of its phases?	About 29.5 days (about a month).
3	Have you ever seen the ocean or a big lake with high and low water? What do you think causes tides?	Tides are caused mostly by the Moon's gravity pulling on Earth's oceans.

2. MINI-LESSON

0:08–0:20 · 12 min

Project the Lesson presenter from the room page. It runs the whole hour: target and agenda, warm-up with timer, hook vote, 4 teaching steps (key idea, interactive tool, turn and talk, check for understanding), I do / we do / you do, a work-time screen with a timer and expectations, debrief, and the exit ticket. Press N for teacher notes, T to pause the timer, and P to pick a student.

Hook (1 min): On April 8, 2024, the sky over Indiana went dark at midday. What lined up? Class vote: Sun - Moon - Earth / Sun - Earth - Moon / Earth - Sun - Moon

Step 1 (3 min): Gravity and orbits

Teach	Gravity pulls objects toward each other. An orbit happens when an object moves forward fast while gravity pulls it inward, so it keeps "falling around" the bigger object.
Interactive tool	Simulation: Newton's cannon: find the speed that makes an orbit
Students do	Write what happens to the cannonball at slow, medium, and fast speeds.
Turn and talk	If gravity suddenly turned off, what would the Moon do? Why?
Worksheet Part 5A	GRAVITY pulls objects toward each other. An ORBIT is forward motion plus gravity pulling inward.
Check for understanding	What keeps the Moon in orbit around Earth? Answer: (A) Earth's gravity and the Moon's forward motion

Step 2 (3 min): Moon phases

Teach	The Moon is always half lit. As it orbits, we see more (waxing) or less (waning) of the lit half: new -> crescent -> quarter -> gibbous -> full and back.
Interactive tool	Simulation: Move the Moon and watch the phase from Earth
Students do	Draw 4 Moon shapes: new, first quarter, full, third quarter.
Turn and talk	Why is the Moon always half lit, even at a new moon?
Worksheet Part 6A	When we see more of the lit half each night, the Moon is WAXING. When we see less, it is WANING.
Check for understanding	Tonight is a full moon. What phase comes next? Answer: (D) Waning gibbous

Step 3 (3 min): Eclipses

Teach	Solar eclipse: Sun-Moon-Earth line up and the Moon's shadow falls on Earth (only at new moon). Lunar eclipse: Sun-Earth-Moon line up and Earth's shadow falls on the Moon (only at full moon).
Interactive tool	Simulation: Line up Sun, Earth, and Moon
Students do	Sketch the line-up for a solar eclipse and a lunar eclipse.
Turn and talk	Why don't we have a solar eclipse every single month at the new moon?
Worksheet Part 7A	A SOLAR eclipse happens at new moon. A LUNAR eclipse happens at full moon.
Check for understanding	During a lunar eclipse, whose shadow covers the Moon? Answer: (A) Earth's

Step 4 (3 min): Tides

Teach	The Moon's gravity pulls Earth's oceans into two bulges: one facing the Moon and one on the far side. As Earth rotates through them, most coasts get two high tides and two low tides a day.
Interactive tool	Board and notes
Students do	Draw Earth, the Moon, and the two ocean bulges.
Turn and talk	The Sun also pulls on the oceans. Why does the Moon have a bigger effect on tides?
Worksheet Part 8A	The Moon's GRAVITY makes two ocean bulges, so most coasts get TWO high tides each day.
Check for understanding	How many high tides do most coasts get each day? Answer: (A) Two

I do: worked example (shown one step at a time)

1. Imagine the Sun, Earth, and the Moon in a row.
2. Step 1: Moon between the Sun and Earth: that is a new moon.
3. Step 2: If the line is perfect, the Moon's shadow falls on Earth: solar eclipse.
4. Step 3: Earth between the Sun and the Moon: that is a full moon.
5. Step 4: If the line is perfect, Earth's shadow falls on the Moon: lunar eclipse.

What to say on every slide is in the presenter script PDF.

We do: guided practice

Tonight is a first quarter moon. What phase will you see in about one week? What about two weeks?

1. The order after first quarter is waxing gibbous, then full.
2. It takes about one week to go from one main phase to the next.
3. In one week: full moon.
4. In two weeks: third quarter (the other half is lit).

Answer: Full moon, then third quarter

You do: independent check (2 min)

During a solar eclipse, what is the order of the objects? (A) Moon - Sun - Earth (B) Sun - Moon - Earth (C) Sun - Earth - Moon (D) Earth - Sun - Moon

Answer: (B) Sun - Moon - Earth. Students who miss it: 3-minute reteach at the teacher table, then start the room at the Explorer level.

Misconception: "There is no gravity in space." Gravity reaches across space; astronauts float because they are falling around Earth.

Misconception: "Moon phases are caused by Earth's shadow." Only lunar eclipses involve Earth's shadow.

Misconception: "Summer happens when Earth is closest to the Sun." Earth is closest in January. Tilt causes seasons.

3. ESCAPE ROOM: GRAVITY STATION ESCAPE

0:20–0:48 · 28 min

Launch: project the start screen, read the story aloud, and assign mission levels (Explorer = extra support, Agent = on level, Legend = challenge). Students can open Supports any time for read-aloud, bigger text, a word bank, and a scratch pad.

- Locks open in order, so every student moves through the same sequence. Circulate and listen for which lock is causing a traffic jam.
- Pairs work well: one student reads the clue card aloud, the other controls the device. Switch roles at every lock.
- If a group is stuck for more than 3 minutes, ask "What does the clue card say about this?" before giving the hint.

Students turn in: the completion code plus their copied "turn in your work" block (Canvas Text Entry).

4. DEBRIEF

0:48–0:52 · 4 min

1. Explain why the April 2024 eclipse could only happen during a new moon.

2. What would happen to the Moon if Earth's gravity suddenly disappeared?
3. Which model from today would you use to teach a 4th grader about phases?

Close the loop: return to warm-up question 3. Answer: Tides are caused mostly by the Moon's gravity pulling on Earth's oceans.

5. EXIT TICKET

0:52–1:00 · 8 min

Print the exit ticket PDF (page 2 is the key and mastery guide). Every item requires evidence: Part A asks students to justify each choice, Part B asks for an explanation, and Part C applies the standard to a new situation using Claim-Evidence-Reasoning. Sort results into Mastered, Approaching, and Beginning to plan tomorrow's groups.

LESSON RESOURCES

Resource	How it fits the lesson
Warm-up worksheet (PDF)	Optional standalone warm-up (also Part 2 of the lesson worksheet), with a key.
Mini-lesson presenter	Projectable, step-by-step interactive lesson with tools and quick checks (room page).
Lesson worksheet (PDF + key)	One printable packet students complete during the whole lesson: short fill-ins and quick checks in 13 small parts that match the presenter slides.
Gravity Station Escape (.html)	The escape room for Canvas, with differentiated levels, supports, and a turn-in.
Exit ticket (PDF + key)	Evidence-based check with a rubric and a mastery sorting guide.
NASA Science: Eclipses (extra)	Eclipse diagrams, videos, and the 2024 Indiana eclipse path. https://science.nasa.gov/eclipses/
NASA Space Place (extra)	Explainers on tides, gravity, and phases. https://spaceplace.nasa.gov/
PhET: Gravity and Orbits (extra)	Turn gravity off and watch the Moon fly away. https://phet.colorado.edu/
NOAA Tides & Currents (extra)	Real tide charts for any U.S. coast. https://tidesandcurrents.noaa.gov/

ANSWER KEY: GRAVITY STATION ESCAPE

Lock 1: What Is Gravity? (code piece: F)

1. Which pair has the strongest gravitational pull between them? -> Earth and the Moon
2. What happens to gravity between two objects as they move farther apart? -> It gets weaker
3. True or false: You pull on Earth with gravity, too. -> True

Lock 2: Weightless? (code piece: O)

1. Why do astronauts float on the space station? -> They are in free fall, falling around Earth with the station
2. About what percent of Earth's surface gravity is felt at the height of the space station? -> 90 %

Lock 3: How Orbits Work (code piece: R)

1. If Earth's gravity suddenly disappeared, what would the Moon do? -> Fly off in a straight line
2. What keeps the planets in orbit around the Sun? -> The Sun's gravity combined with the planets' forward motion
3. Which planet feels the strongest pull from the Sun's gravity for its mass? -> Mercury, because it is closest

Lock 4: Mass vs. Weight (code piece: C)

1. About how much would the astronaut weigh on the Moon? -> 30 pounds
2. On the Moon, what happens to the astronaut's MASS? -> It stays the same
3. About how much would the astronaut weigh on Jupiter? -> 450 pounds

Lock 5: Steering Home (code piece: E)

1. Match each motion to what causes it. -> The Moon orbiting Earth = Earth's gravity; Earth orbiting the Sun = The Sun's gravity; Ocean tides on Earth = Mainly the Moon's gravity; Jupiter's moons orbiting Jupiter = Jupiter's gravity
2. Why does the Sun's gravity control the whole solar system? -> The Sun has more than 99% of the solar system's mass

Final code: FORCE